J. HYM. RES.
Vol. 6, 1997, pp. 10–35

Revision of North American *Aleiodes* Wesmael (Part 1): the *pulchripes* Wesmael Species-group in the New World (Hymenoptera: Braconidae, Rogadinae)

Scott R. Shaw, Paul M. Marsh and Joseph C. Fortier

(SRS, JCF) Department of Plant, Soil, and Insect Science, P.O. Box 3354, University of Wyoming, Laramie, Wyoming 82071 USA; (PMM) Cooperating Scientist, USDA Systematic Entomology Laboratory, % U.S. National Museum of Natural History, NHB-168, Washington, D.C. 20560 (correspondence address: P.O. Box 384, North Newton, Kansas 67117 USA)

Abstract.—The *Aleiodes pulchripes* Wesmael species-group is defined to include the following previously described New World species: *flavidus* (Cresson) 1865, *pedalis* Cresson 1869, *quebecensis* Provancher (1880), *geometrae* (Ashmead) 1889, *cameronii* (Dalla Torre) 1898, *insignipes* (Brues) 1912, and *vaughani* (Muesebeck) 1960. Six newly described species are also included: *arizonensis* Marsh and Shaw, *cazieri* Marsh and Shaw, *earinos* Shaw, *notozophus* Marsh and Shaw, and *rossi* Marsh and Shaw. The *pulchripes* species-group is defined by its exceptionally large ocelli and eyes, compact flagellomeres, pectinate tarsal claws, extensive granulate propodeal microsculpture, and first metasomal tergum with weakly rugulose to rugulocostate sculpture. Revised status is indicated for the species *cameronii*, *flavidus*, *insignipes*, *pedalis*, *quebecensis*, *geometrae*, and *vaughani*, which have been previously classified in the genus *Rogas* Nees. *Rhogas nigriceps* Enderlein is an older name for *vaughani*, but is a junior homonym of *nigriceps* Wesmael. *Rogas enderleini* Shenefelt is an unnecessary replacement name for *nigriceps* Enderlein, and a junior synonym of *vaughani*. A lectotype is designated for *Rhogas geometrae* Ashmead. A preliminary key is provided for the species-groups of Nearctic *Aleiodes*, a key to the New World species of the *pulchripes* species-group is provided, and species treatments are given including diagnostic characters, distribution, and biological information.

INTRODUCTION

The rogadine braconid genus *Aleiodes* Wesmael is worldwide in distribution, but is particularly species-rich in the Holarctic region. *Aleiodes* is well diversified in North America, but anyone reviewing the recent synoptic literature (e.g. Marsh 1979; Shenefelt 1975) might overlook this fact. Marsh (1979) in the Catalog of Hymenoptera in North America north of Mexico treated only three species under *Aleiodes*. More recently authors have recognized that many of the species previously classified as *Rogas* Nees should be transferred to *Aleiodes* (van Achterberg 1982, 1985, 1991, 1995; Marsh 1989; M. Shaw 1994; M. Shaw and Huddleston 1991; S. Shaw 1993, 1995). Even so, the 1979 catalog greatly underestimates the diversity of the group in North America. Forty-one species are listed under *Rogas* and *Aleiodes* combined (all of which should be assigned to *Aleiodes*), but we now estimate that the total in the United States and Canada alone is at least 90 species, and new species are still being discovered.

The species of *Aleiodes* are koinobiont endoparasitoids of lepidopteran larvae, especially macrolepidoptera of the superfamilies Noctuoidea and Geometroidea, and to a lesser extent, Arctioidea, Sphingoidea, and Papilionoidea (M. Shaw 1983, 1994; M. Shaw and Huddleston 1991; S. Shaw 1995). The method of parasitism, unique to the tribe Rogadini, is noteworthy: the *Aleiodes* larva completes its feed-

ing and pupates within the shrunken and mummified remains of the host caterpillar. In all known cases, the form of the mummy caused by a particular *Aleiodes* species is characteristic for that host and parasitoid, so the mummified remains are of considerable diagnostic value and should be retained with the parasitoid, when reared. These host mummies are usually attached to the host plant substrate (leaf, grass blade, stem) at the prothoracic region of the host larva, by a glue-like substance that exudes through a prosternal hole chewed by the parasitoid larva. Exit from the host mummy is always postero-dorsally, through a circular hole. The inside of the mummy is lined with silk by the parasitoid larva, but the main support for the mummy seems to be the formation of a premature host pupal cuticle below the remaining larval cuticle. The physiological basis for host mummification has not been investigated experimentally in *Aleiodes*, but we speculate that it may involve the physical elimination of the host's corpora allatum by the developing parasitoid larva, which would reduce juvenile hormone levels and induce the premature formation of pupal cuticle. This hypothesis is consistent with the observation that larval feeding by *Aleiodes* is usually (all groups except *albitibia*) located initially in the prothoracic region of the host (e.g. the chewing of the glue-hole).

Currently, two of us (JCF and SRS) are conducting a phylogenetic analysis of the species of *Aleiodes* worldwide, and this is now complete enough to provide us with a logical framework for dividing the North American species into monophyletic species groups. Therefore, our present plan is to publish a series of shorter papers on species-groups, of which this paper is the first.

Our original intent was to provide revisionary coverage of North America north of Mexico, and for this area our study is most complete. Nevertheless, it is clear that this boundary is quite artificial and that some coverage of Neotropical species may be necessary. For example, two species of the *pulchripes* group (*cameronii* and *notozophus*) have ranges that extend from the southern United States southwards to Costa Rica. Three Neotropical species (*flavidus, pedalis,* and *vaughani*) have ranges that extend to areas just south of the U.S. borders (northern Mexico and Cuba), and it seems likely to us that they may eventually be found in southern parts of the U.S. With this paper we have decided to treat a complete monophyletic assemblage of species rather than some subset as circumscribed by geographical boundaries.

METHODS

Species covered in this paper can be identified as members of the subfamily Rogadinae using the keys of S. Shaw (1995) or M. Shaw and Huddleston (1991). Our definition of *Aleiodes* follows that of S. Shaw (1993) and van Achterberg (1991). Specimens can be determined as *Aleiodes* using the keys of van Achterberg (1991), or Marsh et al. (1987). Specimens keyed through Marsh et al. (1987) will key to couplet 185, at which point they can be separated from *Rogas* by the presence of a discrete median carina on the propodeum, the lack of a foveate sternaulus on the mesopleuron, and the lack of a blunt basal tooth on the tarsal claw. In practice, more than 99% of U.S. and Canadian specimens encountered will be *Aleiodes*, as true *Rogas* is mainly a tropical group that is infrequently encountered north of Mexico.

Terminology mostly follows that used for *Aleiodes* by S. Shaw (1993) and Marsh (1989). Microsculpture terminology follows that of Harris (1979). Wing venation terminology agrees with the system being adopted for the Identification Manual for New World Genera of the Family Braconidae, and agrees closely to that of Goulet and Huber (1993). To avoid confusion, wing illustrations with veins and cells

used in this paper are provided (Figs. 41–43).

Abbreviations for museums are as follows: ANSP, Academy of Natural Sciences, Philadelphia, PA; AEI, American Entomological Institute, Gainesville, FL; AMNH, American Museum of Natural History, New York, NY; ABS, Archbold Biological Station, Lake Placid, FL; CAS, California Academy of Sciences, San Francisco, CA; CNC, Canadian National Collection, Ottawa; CUI, Cornell University, Ithaca, NY; FSCA Florida State Collection of Arthropods, Gainesville, FL; INHS, Illinois Natural History Survey, Urbana, IL; INBio Instituto Nacional de Biodiversidad, Heredia, Costa Rica; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, MA; MISU, Michigan State University, East Lansing, MI; MSSU, Mississippi State University, Mississippi State, MS; NNML, Nationaal Natuurhistorisch Museum, Leiden, The Netherlands; OKSU Oklahoma State University, Stillwater, OK; TAMU, Texas A&M University, College Station, TX; NHM, The Natural History Museum, London; UCD, University of California, Davis, CA; ULQ, Universite Laval, Quebec; UKL, University of Kansas, Lawrence, KS; UMCP, University of Maryland, College Park, MD; UMSP, University of Minnesota, St. Paul, MN; RMSEL, Rocky Mountain Systematic Entomology Laboratory, University of Wyoming, Laramie, WY; USNM, U.S. National Museum of Natural History, Washington, D.C.

Authorship of the new species is attributed to the senior authors in the order indicated for each species, Marsh and Shaw, except for *earinos* which is attributed to Shaw.

PRELIMINARY KEY TO THE SPECIES-GROUPS OF NEARCTIC *ALEIODES*

1. Apex of hind tibia with a row of flattened setae along inner margin ..... ***seriatus*** species-group
— Apex of hind tibia without a row of flattened setae along inner margin, setae normal and hair-like 2
2(1). First metasomal tergum parallel sided; apex of metasoma laterally compressed in female 3
— First metasomal tergum not parallel sided, wider apically than at base; apex of metasoma not laterally compressed in female 4
3(2). Marginal cell of hind wind narrowest at middle, vein RS sinuate; body color mostly pale yellowish brown ..... ***compressor*** species-group
— Marginal cell of hind wind narrowest at base and widening towards wing apex; body color boldly contrasting black and red ..... ***ufei*** species-group
4(2). Vein RS of hind wing strongly sinuate, nearly reaching anterior wing margin near middle of marginal cell; parasitoids of Sphingidae ..... ***praetor*** species-group
— Vein RS of hind wing straight, bent, or slightly sinuate, not close to wing margin near middle of marginal cell; parasitoids of various groups but never Sphingidae 5
5(4). Central disc of mesopleuron smooth and highly polished; parasitoids of Notodontidae, host mummy with an unusual expanded balloon-like anteroventral area ..... ***albitibia*** species-group
— Central disc of mesopleuron with various types of surface microsculpture, but not smooth and highly polished; parasitoids of various groups but host mummy never with an expanded balloon-like anteroventral area 6
6(5). Clypeus at least 3× wider than tall, with a carina across anterior surface; oral space large and broad, clypeo-antennal space/width of oral space less than or equal to 0.69; malar space narrow, less than mandibular base width ..... ***melanopterus*** species-group
— Clypeus taller or not so wide, and usually without a transverse carina; oral space

smaller and less broad, clypeo-antennal space/width of oral space greater than 0.69; malar space variable, sometimes wider than mandibular base width 7

7(6) Median length of pronotum greater than distance between occipital carina and lateral ocellus; pronotum shelf-like, dorsal surface parallel to dorsal surface of mesonotum ..... ***dispar*** species-group

— Median length of pronotum shorter than distance between occipital carina and lateral ocellus; pronotum not shelf-like, or dorsal surface not parallel to dorsal surface of mesonotum 8

8(7). Metasomal tergite 3 entirely smooth and shining ..... ***gressitti*** species-group

— Metasomal tergite 3 with various types of surface sculpture, especially on basal ½, often with a median carina 9

9(8). Ocelli very large, ocell-ocular distance ⅔ width of lateral ocellus or smaller 10

— Ocelli smaller, ocell-ocular distance broader than ⅔ width of lateral ocellus, often wider than ocellus 11

10(9). Flagellomeres compact, middle flagellomeres less than 2× longer than wide, usually about 1× as long as wide or just slightly longer; males sometimes with setose, circular pits medially on terga 5–7; parasitoids of geometrids, notodontids, and noctuids ..... ***pulchripes*** species-group

— Flagellomeres elongate, middle flagellomeres 2× longer than wide or longer; males with terga 5–7 normal, unmodified; parasitoids of lymantriids ..... ***pallidator*** species-group

11(9). Marginal cell of hind wing narrowest at base and widening toward wing apex, vein RS straight entire length, or parallel with anterior wing margin along basal half only, thus marginal cell suddenly widening 12

— Marginal cell of hind wing narrowest at middle, vein RS slightly sinuate 15

12(11). Tarsal claws strongly pectinate over entire length; males with terga 4–6 densely setose (subdivided medially) ..... ***ductor*** species-group

— Tarsal claws not pectinate, or with pectin concentrated at base of claw; males with terga 4–6 normal, not densely setose 13

13(12). Metasomal terga 1 and 2 extremely coarsely sculptured, strongly porcate with rugae between ridges; body color black ..... ***rugulosus*** species-group

— Metasomal terga 1 and 2 more finely sculptured, finely rugose, to costate rugose or coriaceous rugose; body usually not all black, varying from brown, to orangish brown, black and brown, or black and orange 14

14(13). Malar space narrow, less broad than basal width of mandible; body color black with bicolored black and orange metasoma ..... ***unipunctator*** species-group

— Malar space wide, broader than basal width of mandible; body color variable but commonly brown or orangish brown, and never with a bicolored black and orange metasoma ..... ***gasterator*** species-group

15(11). Vertex sculpturing rugose, with strong laterally-running ridges; metasomal tergum 4 mostly covered with coarse granular punctate or rugose sculpture; several species with metasomal terga 1–4 forming a partial to complete carapace ..... ***coxalis*** species-group (including *Tetrasphaeropyx* Ashmead)

— Vertex sculpturing either smoother or more irregular, not dominated by strong laterally-running ridges; metasomal tergum 4 mostly covered with fine granular sculpture, or mostly smooth and shining; metasomal terga 1–4 never carapace-like, terga 5–7 exposed 16

16(17). Ocelli small, ocell-ocular distance larger than width of lateral ocellus; metasoma always bicolored with black anteriorly and laterally, yellow to yellowish white medially, black sometimes continuing posteriorly to enclose lighter median spot ..... ***circumscriptus*** species-group

— Ocelli larger, ocell-ocular distance smaller than width of lateral ocellus; metasoma

color variable, but often mostly yellow or with black restricted to anterior parts of tergum 1, less commonly with dark markings as above ..... ***gastritor*** species-group

---

ALEIODES PULCHRIPES SPECIES-GROUP

Included species: *pulchripes* (Wesmael) 1838, *fortipes* (Reinhard) 1863, *flavidus* (Cresson) 1865, *pedalis* Cresson 1869, *quebecensis* Provancher (1880), *geometrae* (Ashmead) 1889, *cameronii* (Dalla Torre) 1898 (=*mexicanus* Cameron [preoccupied]), *insignipes* (Brues) 1912, *vaughani* (Muesebeck) 1960 (=*nigriceps* Enderlein [preoccupied], =*enderleini* Shenefelt [unnecessary replacement name]), *caucasicus* (Tobias) 1975, *antennatus* (Belokobylskij) 1988, *arsenjevi* (Belokobylskij) 1988; *arizonensis* new species, *cazieri* new species, *earinos* new species, *notozophus* new species and *rossi* new species.

Remarks.–A small, but distinctive, presumably monophyletic group restricted to the New World. As far as known, they are associated with exposed-feeding geometrids, notodontids, and noctuids, mostly on arboreal vegetation. Members of the *pulchripes* species-group have strongly pectinate tarsal claws (Figs. 14, 16, 18), often with more than 10 teeth comprising the pectin. Sculpturing of the first metasomal tergum is weakly rugulose to faintly rugulocostate; while the third metasomal tergum sculpturing is shallowly rugulose or rugulocostate anteriorly, and finely punctate and nitid posteriorly, or completely punctate-nitid. They have large to enormous ocelli, ranging from 1.5–9.0 times wider than the ocell-ocular distance. The malar space is shorter than the mandibular base, thus the compound eyes appear very large as well. The antenna is long, with 43–70 antennomeres, but individual flagellomeres are short and compact. All members of the group have the antero-lateral margin of the propodeum granulate, with just a trace of costation. In some the propodeum is almost entirely granulate. This group includes all known species with males having setose pits on terga 4–7 (a striking synapomorphy), but some included species never evolved this character.

KEY TO THE NEW WORLD SPECIES OF THE *PULCHRIPES* SPECIES GROUP

1. Fore wing longer than 9mm, deeply tinted with yellow, usually with dark blackish patches apically, and sometimes medially (Figs. 36–37) 2
— Fore wing shorter than 9mm, clear or only lightly tinted with blackish pigmentation, and lacking dark patches (Figs. 38–40) 3

2(1). Head yellowish orange; apical ¼ of female hind tibia black (Fig. 26); female forewing lacking a dark medial cloud below pterostigma (Fig. 36) ..... ***flavidus*** (Cresson)
— Head and apical ½ or more of female hind tibia black (Fig. 28); wing sometimes with a faint to very distinct darkened medial cloud below pterostigma (Fig. 37) ..... ***pedalis*** Cresson

3(1). Marginal cell of hind wing narrowest at apical ⅔, vein RS slightly arched at its apical ⅔; hind tarsus pale yellowish or white (Fig. 24) ..... ***quebecensis*** (Provancher)
— Marginal cell of hind wing narrowest at base and usually widening toward wing apex, vein RS straight entire length or parallel with wing margin on basal half only, thus suddenly widening (Figs. 41–43); hind tarsus variable, but not white 4

4(3). Body multicolored, head black or dark brown, mesosoma variously marked with black, brown, yellow or orange 5
— Body unicolored orange or honey-yellow 7

5(4). Tarsal claw strongly pectinate, without a distinct gap between apical claw and basal

pectination; hind tarsus dark reddish brown; male with small setose pits medially on terga 4–7. . . . . ***notozophus*** new species

— Tarsal claw more weakly pectinate or with pectination reduced to mostly seta-like spines, always with a distinct gap between apical claw and basal pectination; hind tarsus dark, usually black or rarely brown; male without setose pits medially on terga 4–7 6

6(4). Ocelli enormous, lateral ocellus about 15 times wider than ocell-ocular distance, nearly touching compound eye; malar space very small, only about half as wide as basal width of mandible; tarsal claw pectination greatly reduced, pectination mostly comprised of seta-like spines concentrated at extreme base; Brazil . . . . . ***insignipes*** (Brues)

— Ocelli smaller, lateral ocellus about 3 times wider than ocell-ocular distance, clearly separated from compound eye; malar space larger, only slightly shorter than basal width of mandible; tarsal claw pectination visible over at least basal half of claw, pectination mostly spine-like or tooth-like; Central America south to Ecuador . . . . . ***vaughani*** (Muesebeck)

7(4). Tarsal claws with a wide gap between the apical claw and basal pectination (Fig. 19); occipital carina broadly effaced medially (Figs. 6, 35) 8

— Tarsal claws with basal pectination extending fully to base of apical claw (Figs. 16, 18, 20, 21); occipital carina complete or only slightly interrupted medially 9

8(7). First metasomal tergum shorter than wide; propodeal sculpture mostly granulate dorsally; vein 1cu-a of fore wing beyond vein 1M by distance greater than length of 1cu-a . . . . . ***geometrae*** (Ashmead)

— First metasomal tergum distinctly longer than wide; propodeal sculpture mostly rugose dorsally, greatly obscuring granulate base sculpture; vein 1cu-a of fore wing beyond vein 1M by distance equal to or less than length of 1cu-a ***earinos*** new species

9(7). Vein 1cu-a of fore wing beyond vein 1M by distance less than length of vein 1cu-a (Fig. 41); tarsal claw with very large pectination, with 3–6 stout spines of the basal pectin about as large as the apical claw (Fig. 16); males with exceptionally large, circular setose pits on metasomal terga 4–7 (as in Fig. 13) . . . . . ***cameronii*** (Dalla Torre)

— Vein 1cu-a beyond vein 1M by distance greater than length of vein 1cu-a (Figs. 49, 40); tarsal claw with smaller pectination, stout spines of the basal pectin obviously smaller than apical claw (Figs. 18, 20); males with smaller setose pits on terga 4–7 (as in Fig. 15) or none 10

10(9). Antennal flagellum entirely brown . . . . . ***rossi*** new species

— Antennal flagellum black on basal half, orange on most or all apical half 11

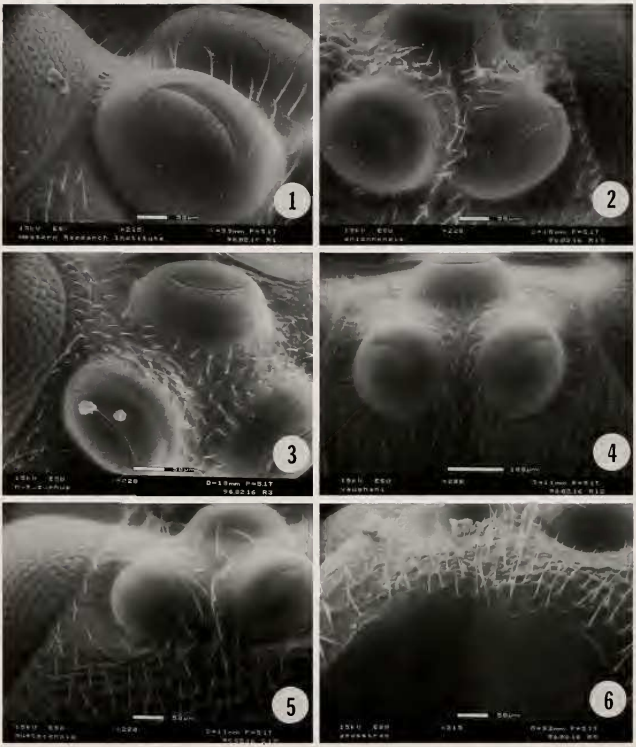
11(10). Apical 3–5 flagellomeres black or brown; stigma of fore wing entirely yellow (Fig. 39); vein 1M of hind wing 1.5 times longer than vein r-m; male with median dorsal pits on metasomal terga 4–7 . . . . . ***arizonensis*** new species

— Apical half of flagellum entirely orange; stigma dark brown to black medially, yellow only basally and at extreme apex (Fig. 40); vein 1M of hind wing only slightly longer than r-m, at most 1.2 times longer; male without median dorsal pits on metasomal terga 4–7 . . . . . ***cazieri*** new species

---

Aleiodes arizonensis Marsh and Shaw, new species
(Figs. 2, 39)

Female.—**Body color**: unicolored honey yellow, antenna black on basal half, orange on apical half except apical 3–5 flagellomeres darkening to brown, ocellar triangle black, wings lightly yellowish, veins brown except C+Sc+R, stigma and 1R1 yellow (Fig. 39). **Body length**, 8.0 mm; fore wing length, 8.0 mm. **Head**: 64 antennomeres, all flagellomeres, except apical ½, as wide as long, those in apical ⅓ slightly longer than wide; malar space short, less than basal width of mandible and ⅓ eye height; temple very narrow, about ⅓ eye



Figs. 1–6. Head vertices of *Aleiodes* spp.: 1, ocelli of *flavidus* (215×); 2, ocelli of *arizonensis*, (220×); 3, ocelli of *notozophus*, (220×); 4, ocelli of *vaughani*, (200×); 5, ocelli of *quebecensis*, (220×); 6, head of *geometrae*, postero-dorsal view showing effaced occipital carina (215×).

width; occipital carina not reaching hypostomal carina, weakly interrupted on vertex behind ocelli; oral space small and circular, diameter about equal to basal width of mandible; clypeus weakly swollen; ocelli large, ocellocular distance ¼ diameter of lateral ocellus (Fig. 2); face rugulose-costate, frons smooth, vertex and temple granulate; maxillary palpus not swollen. **Mesosoma**: pronotum with me-

dian scrobiculate line, rugulose above, granulate below; mesonotum and scutellum granulate, notauli weakly scrobiculate, meeting in triangular rugose area before scutellum; mesopleuron smooth and shining, subalar sulcus carinate, sternaulus absent; propodeum rugose-granulate dorsally, smooth laterally, median carina complete. **Legs**: tarsal claws strongly pectinate; inner spur of hind tarsus ½ length of hind basitarsus; hind coxa granulate dorsally. **Wings** (Fig. 39): fore wing with vein r ⅔ length of 3RSa and ⅔ length of m-cu, vein 1cu-a beyond 1M by distance greater than length of 1cu-a, vein 1CUa ⅖ length of 1CUb; hind wing with marginal cell gradually widening, vein RS straight, vein 1M about 1.5 times longer than 1r-m, vein M+CU slightly longer than 1M, vein m-cu absent. **Metasoma**: first tergum rugulose, longer than apical width, median carina complete; second tergum costate-rugulose, median carina complete; third tergum weakly costate-rugulose basally, granulate apically, median carina present on basal half; remainder of terga granulate; ovipositor about ½ length of hind basitarsus.

Male.—Essentially as in female; metasomal terga 4–6 with small circular median dorsal pits.

Holotype female.—ARIZONA: Ramsey Canyon, 5000 ft., 15 mi. S. Sierra Vista, Huachuca Mountains, September 17, 1967, Sternizky. Deposited in CNC.

Paratypes.—ARIZONA: 1 male, 1 female, same data as holotype except female with date of May 1968. Paratypes deposited in USNM, RMSEL.

Distribution.—Known only from the type locality in Arizona.

Biology.—Unknown.

Comments.—This species is similar in morphology and distribution to *cazieri* but is distinguished by the males with median pits on metasomal terga 4–6, by the entirely yellow pterostigma (Fig. 39), by the longer vein 1M in the hind wing, and by the dark tip of the antenna.

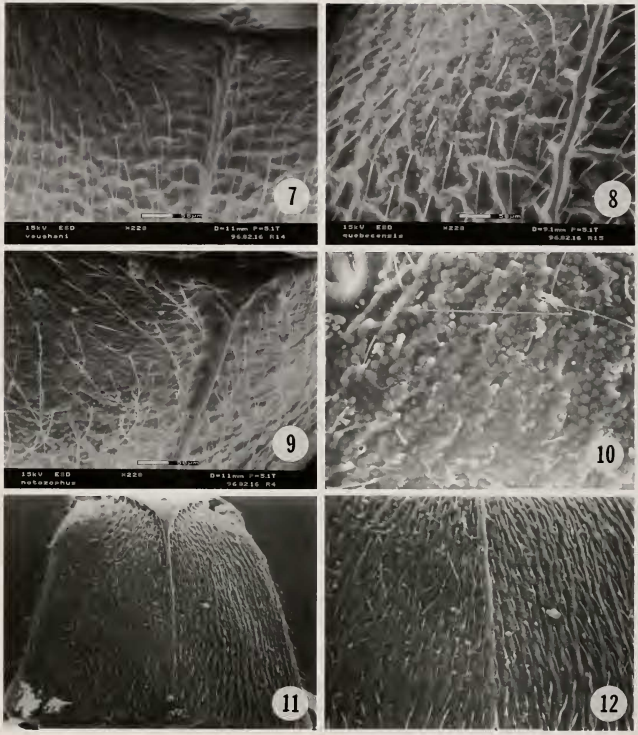
Etymology.—Named after the type locality of Arizona.

Aleiodes cameronii (Dalla Torre), new combination
(Figs. 10–13, 16, 21, 33, 41)

Rhogas mexicanus Cameron, 1887, Biol. Cent.-Amer., Hym. 1:389. Preoccupied in *Aleiodes* by *mexicanus* Cresson, 1869.

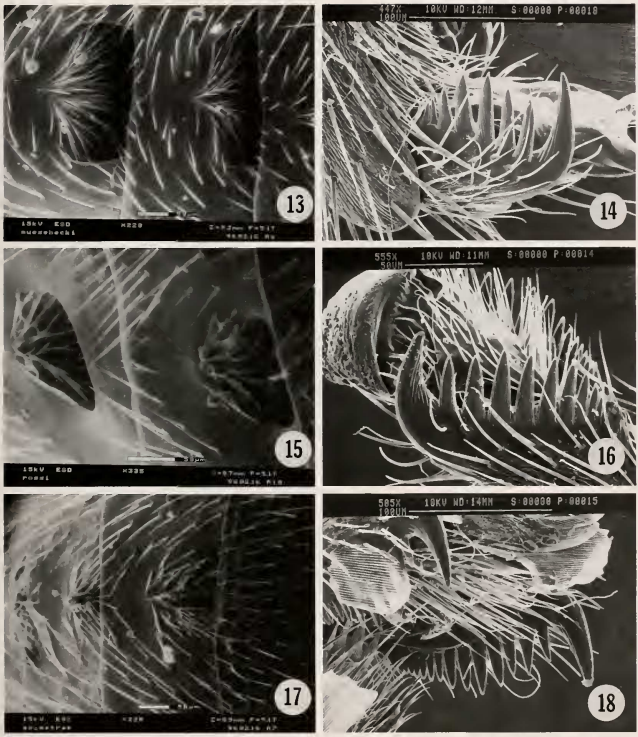
Rhogas cameronii Dalla Torre, 1898, Cat. Hym. 4: 216. Replacement name for *mexicanus* Cameron.

Diagnosis.—Body color honey yellow, antennae and ocellar triangle brown, wings hyaline, veins brown except stigma and occasionally C+Sc+R yellow; 60–65 antennomeres, first flagellomere only slightly longer than second, flagellomeres 2–30 as long as wide, remainder slightly longer than wide; malar space (Fig. 33) short, $1/10$ eye height and ½ basal width of mandible; temple narrow, ⅓ eye width; occipital carina not quite meeting hypostomal carina; oral space (Fig. 33) small and circular, width twice malar space and about equal to length of face; ocelli large, lateral ocellus nearly touching eye, ocellar distance $1/12$ greatest diameter of lateral ocellus; face finely costate-rugulose, clypeus rugulose; frons, vertex, and temple finely granulate; maxillary palpus not swollen; mandibles small; mesonotum and scutellum granulate; notauli weakly scrobiculate, meeting posteriorly in triangular rugulose area; mesopleuron smooth except for hair pits, subalar sulcus costate, sternaulus absent; propodeum (Fig. 10) granulate, rugulose at apex and along complete median carina; tarsal claws strongly pectinate on entire inner edge (Fig. 16, 21); inner spur of hind tibia about ½ length of hind basitarsus; hind coxa smooth dorsally; fore wing (Fig. 41) with vein r about ⅔ length of 3RSa and about ¾ length of m-cu, vein 1cu-a beyond 1M by distance equal to half length of 1cu-a, vein 1CUa about ⅕ length of 1CUb; hind wing (Fig. 41) with marginal cell suddenly wid-



Figs. 7–12. Figs 7–10. Propodea of *Aleiodes* spp.: 7, *vaughani*, dorsal view of left antero-lateral area (220×); 8, *quebecensis*, dorsal view of left antero-lateral area (220×); 9, *notozophus*, dorsal view of left antero-lateral area (220×); 10, *cameronii*, dorsal view of left antero-lateral area (300×). Figs 11–12. First metasomal terga of *Aleiodes* spp. 11, *cameronii* (78×); 12, *cameronii* (110×).

ening from basal ¼ of cell, vein RS sharply curved downward, vein 1r-m ½ length of 1M, veins M+CU and 1M about equal in length, vein m-cu short and distinct, often arising from 2M; first metasomal tergum (Figs. 11, 12) costate-rugulose, slightly longer than apical width, median carina complete; second tergum costate-rugulose, median carina complete; third tergum costate at base, granulate on apical half, me-

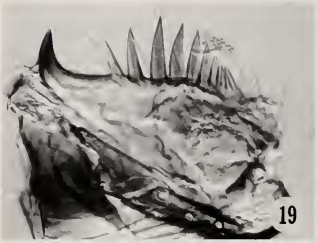


Figs. 13–18. Figs 13, 15, 17. Setose dorso-medial tergal pits of male *Aleiodes* spp.: 13, *cameronii* (220×); 15, *rossi* (335×); 17, *geometrae* (220×). Figs. 14, 16, 18. Tarsal claws of *Aleiodes* spp.: 14, *quebecensis* (447×); 16, *cameronii* (555×); 18, *cazieri* (505×).

dian carina on basal half; remainder of terga granulate; ovipositor barely exerted, about ¼ length of hind basitarsus; male metasomal terga 5–7 with large dorsal median circular pits (Fig. 13).

Type material examined.—*Rhogas mexicanus* Cameron, holotype male, "Mexico, Presidio" [NHM].

Distribution.—This species occurs throughout the entire southern United States, and southwards through Mexico to Costa Rica. In the United States it ranges



Figs. 19–22. Compound microscope photographs of slide-mounted claws of *Aleiodes* spp.: 19, *geometrae*; 20, *rossi*; 21, *cameronii*; 22, *vaughani*.

from Massachusetts, Maryland, and Virginia in the east, southwards to Florida, and westwards to California. The northern-most record is from Michigan. Cameron indicates the type locality as Presidio, Mexico but we could not find this locality in any atlas. Perhaps the correct location was Presidio, Texas from which we have seen many specimens.

Biology.—*Aleiodes cameronii* has been reared in Maryland by Paul Gross, Alex Segarra and Pedro Barbosa from three hosts on willow (*Salix nigra*): a geometrid, *Eutrapela clemataria* (J.E. Smith), and two catocaline noctuids, *Zale lunata* (Drury) and *Catocala cara* Gn. The mummy formed in the later case is about 1.5 cm long, dark brown, densely wrinkled over the apical ½, and terminating with long caudal prolegs that form a conspicuous forked "tail" at the tip of the mummy. Another specimen has a host mummy attached with it, which is presumed to be an unidentified species of Notodontidae. Also, several specimens were collected at lights indicating this species is nocturnally active.

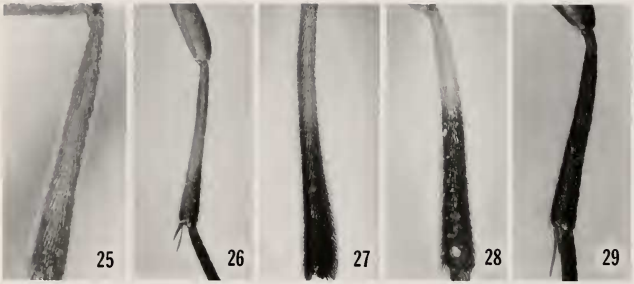
Comments.—This species belongs to the group in which the males have distinctive setose median pits on the apical metasomal terga, but the pits in *cameronii* are larger than in any other known species. *Aleiodes cameronii* is distinguished from most others in the species-group by vein 1cu-a of the forewing being close to 1M (Fig. 41). Only *earinos* has similar venation, but in *earinos* the occipital carina is not complete and the tarsal claw is not so fully and extremely pectinate as in *cameronii* (Fig. 16). The pits on the male metasomal terga are curious and their detailed mor-

Figs. 23–24. Color patterns of *Aleiodes* spp.: 23, apical flagellomeres of *quebecensis*; 24, hind tibia and tarsus of *quebecensis*.

phology, both external and internal, need to be studied further. We hypothesize that these probably may serve to disperse sex pheromones, and behavioral studies of the courtship in this and related species might be interesting.

Aleiodes cazieri Marsh and Shaw, new species (Figs. 18, 40)

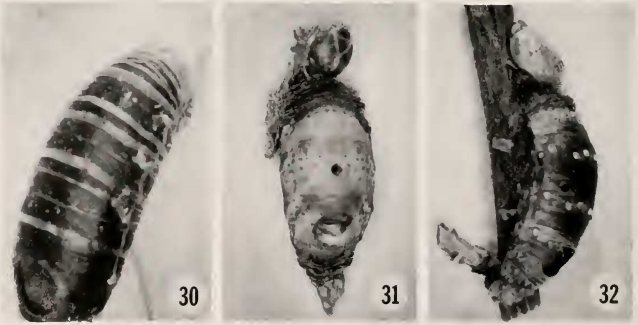
Female.—**Body color**: unicolored, entire body including legs honey yellow, antenna with scape, pedicel and basal ½ of flagellum black, apical ½ of flagellum orange, wings slightly yellowish, veins brown, fore wing with vein C+Sc+R, basal and apical spots on stigma, and vein 1R1 yellow. **Body length**, 9 mm; fore wing length, 8 mm. **Head**: 65 antennomeres, first flagellomere slightly longer than second, remainder slightly longer than wide; malar space short, slightly shorter than basal width of mandible and about ⅕ eye height; temple narrow, about ⅓ eye width; occipital carina meeting hypostomal carina; oral space small and circular, width equal to malar space and about ½ face height; clypeus not swollen; ocelli large, ocellocular distance about ⅓ diameter of lateral ocellus; face rugulose, with median ridge below antennae; frons smooth; vertex and temple granulate; maxillary palpus not swollen; mandibles small, tips not overlapping when closed. **Mesosoma**: pronotum rugose laterally, granulate dorsally; mesonotum and scutellum granulate; notauli scrobiculate, meeting in triangular rugose area before scutellum; mesopleuron smooth, subalar sulcus rugose; sternaulus absent; propodeum rugose, median carina obscured apically. **Legs**: tarsal claws completely pectinate, with 10–15 stout spines on inner edge (Fig. 18); inner spur of hind tibia about ⅓ length



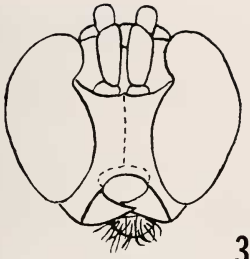
Figs. 25–29. Variation in hind tibia color patterns of *Aleiodes* spp.: 25, *geometrae* female; 2, *flavidus* female; 27, *flavidus* male; 28, *pedalis* female; 29, *notozophus* female.

of hind basitarsus; hind coxa rugose dorsally. **Wings**: (Fig. 40) fore wing with vein r about ⅓ length of 3RSa and about ½ length of m-cu, vein 1cu-a beyond 1M by twice length of 1cu-a, vein 1CUa slightly more than ½ length of 1CUb; hind wing with vein RS straight, marginal cell gradually widening to wing apex, vein 1r-m equal in length to 1M, vein M+CU longer than 1M, vein m-cu short and distinct, leaving 1M before junction with 1r-m and 2M. **Metasoma**: first tergum longer than wide, costate-rugulose, median carina complete; second tergum costate-rugulose, median carina complete; third tergum costate on basal ¾, granulate on apical ¼; remainder of terga weakly granulate; ovipositor short, about ⅓ length of hind basitarsus.

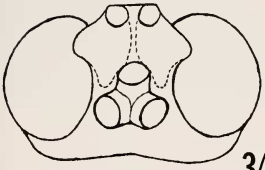
Male.—Essentially as in female; meta-



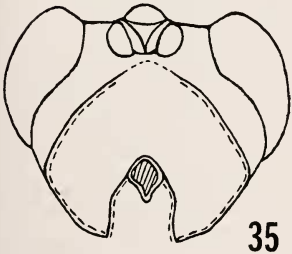
Figs. 30–32. Mummified noctuid host larvae parasitized by *Aleiodes* spp.: 30, *geometrae*; 31, *vaughani*; 32, *quebecensis*.



33



34



35

Figs. 33–35. Head morphology of *Aleiodes* spp.: 33, *cameronii*, anterior view; 34, *notozophus*, dorsal view; 35, *geometrae*, postero-dorsal view showing effaced occipital carina.

somal terga 4–6 without dorsal median pits.

Holotype.—Female: ARIZONA, South West Research Station, 5 mi W. Portal, 5400 ft., Cochise Co., August 4, 1956, C. and M. Cazier collectors. Deposited in AMNH.

Paratypes.—ARIZONA: 1 female, 1 male, same data as holotype except dates of July 27 and August 8, 1956; 2 males, S.W. Res. Sta., 5 mi. W. Portal, August 5, 1959, H. E. Evans, 5400′; 1 male, Ramsey Canyon, 5000 ft., 15 mi S. Sierra Vista, Huachuca Mts., Sternitzky, July 1968. Paratypes deposited in CNC, USNM, AMNH, CUI.

Distribution.—Known only from Arizona.

Biology.—Unknown.

Comments.—This species is somewhat similar to *arizonensis*, but is distinguished by the much smaller ocelli, shorter vein 1M in the hind wing, and the absence of median pits on metasomal terga 4–6 of the male.

Etymology.—Named for its collector, Mont Cazier, who was in charge of the Southwest Research Station in Portal, Arizona for many years.

Aleiodes earinos Shaw, new species
(Fig. 44)

Female.—**Body color**: Body unicolored yellowish to reddish brown, antenna black, wings hyaline, veins light brown, tegula orange. **Body length**, 6.0–7.0 mm; forewing length 5.8–7.3 mm. **Head**: 57–65 antennomeres; malar space short, equal to or less than basal width of mandible; oral opening small, circular; occipital carina weak or absent on vertex; ocelli large, lateral ocellus 4.3 times wider than ocell-ocular distance; face weakly costate, frons, vertex and temple granulate. **Mesosoma**: mesonotum and scutellum granulate; mesopleuron smooth, subalar sulcus weakly rugose, sternaulus absent; propodeum granulate anteriorly, grading to rugose posteriorly (Fig. 44), median carina

Figs. 36–40. Forewings of *Aleiodes* spp.: 36, *flavidus*; 37, *pedalis*, holotype; 38, *notozophus*; 39, *arizonensis*; 40, *cazieri*.

complete. **Legs**: tarsal claws with a wide gap between the apical claw and basal pectination. **Wings**: fore wing with vein 1cu-a beyond 1M by distance equal to or less than length of 1cu-a; hind wing with marginal cell gradually widening apically, vein RS straight, vein r-m nearly as long as 1M. **Metasoma**: first metasomal tergum slightly longer than wide; first and second metasomal terga costate, median carina complete, third tergum costate on basal ½, median carina absent.

Male.—Essentially as in female, except metasomal terga 4–6 with small circular seta-lined median dorsal pits.

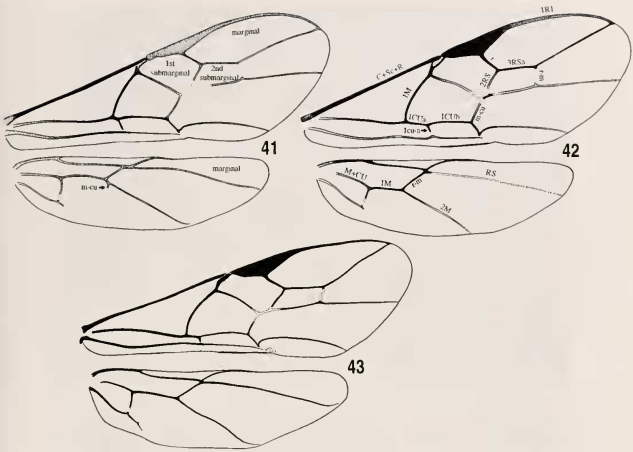
Holotype female.—FLORIDA: Alachua Co., Gainesville, Beville Heights, April 14, 1979, L. Stange, blacklight trap. Deposited in FSCA.

Paratypes.—ARKANSAS: 1 female, Logan Co., Magazine Mt., 2500′, T6N, R25W, sec. 23NW, May 15–16, 1989, J. MacGown, Q. Fang, blacklight trap, William H. Cross Expedition. FLORIDA: 2 females, 1 male, same data as holotype except females collected 12–13 April, 1980, male collected April 4, 1979; 5 females, Lk. Placid, Archbold Biological Station, R.A. Morse, March 23–25, 1964, coll. at light. TEXAS: 1 female, Del Rio, (date illegible), Timberlake coll.; 1 female, Bastrop, Lost Pines Pk., April 6, 1959, W.R.M. Mason. Paratypes deposited in FSCA, MISS, USNM, CNC, RMSEL, CUI.

Distribution.—Known only from Arkansas, Florida, and Texas.

Biology.—The host is unknown, but the flight period is early in the season and *carinos* is attracted to lights.

Comments.—This species is similar to *geometrae*, with which it has been previously confused. Similarities with *geometrae* include a claw with a gap between the apical claw and the basal pectin, weak to incomplete occipital carina, and pits in the male terga 5–7. Differences of *carinos* from *geometrae* include the larger body size, often darker reddish brown color, longer fla-



Figs. 41–43. Wings of *Aleiodes* spp. with principal veins and cells mentioned in descriptions labeled: 41, *cameronii*; 42, *geometrae*; 43, *notozophus*.

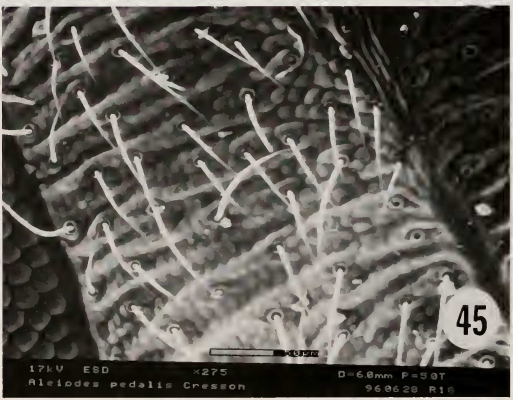
gellum, less broad gap in the occipital carina, vein 1cu-a positioned more basally (more like *cameronii* than *geometrae* with respect to this character), coarser propodeal sculpture (Fig. 44), and much longer first metasomal tergum.

Etymology.—From the Greek *earinos* meaning "of spring," in reference to the early seasonal occurrence of this species.

Aleiodes flavidus (Cresson), new combination (Figs. 1, 26–27, 36)

Rogas flavidus Cresson, 1865, Proc. Ent. Soc. Philadelphia 4:83.

Re-description of type series.—**Body color**: yellow to yellowish orange, except ocellar triangle, antenna, apical ¼ to ½ hind tibia (Fig. 26–27), and hind tarsi black; maxillary palpi yellow; wings yellow, except tips blackish. **Body length**: 9.8 mm; forewing length 9.7 mm. **Head**: ocelli enormous (Fig. 1), lateral ocellus 7.6 times wider than ocell-ocular distance; vertex granulate to very finely rugulose; 70 antennomeres, 15th flagellomere from base width/length less than 0.84, basal flagellomeres not longer than wide; medial facial ridge extending down frons less than 0.55 of distance from line between bases of scapes to clypeus; malar space very short, shorter than basal width of mandible, malar space/eye height ratio = 0.11; temple/eye height ratio = 0.11; occipital carina effaced medially, complete or nearly so at hypostomal carina; clypeal shape rounded, not abruptly edged, not flat ventrad, clypeus rugulose, without transverse carina, clypeal height/width 0.42–0.65; oral opening circular, width shorter than the clypeo-antennal distance. **Mesosoma**: pronotum granulate medio-



Figs. 44–45. Sculpturing on *Aleiodes* spp.: 44, postero-lateral section of propodeum of *earinos* showing rugose sculpture (195×), 45, face of showing lateral striations (275×).

anteriad, pronotum laterally costate; pronotum declining at angle greater than 45 degrees from mesonotum, pronotal anterior flange less than 0.28 pronotal length, pronotal medial length longer than length between occipital carina and lateral ocellus; mesopleuron sculpturing on and posteriad to central disc smooth, punctate;

sternaulus absent; mesopleural pit posteriad to central disk absent; posterio-dorsal surface of mesonotum with some strong, smooth carinae, notauli at mid-dorsal surface of mesonotum not coarsely foveate but with a long longitudinal carinae, mesonotal sculpturing excluding posterodorsal surface of mesonotum granulate; scutellum granulate, with pronounced setal pits; median carina of propodeum usually complete to apex; sculpturing of propodeum antero-laterally granulate, faintly rugulose. **Legs**: inner apex of hind tibia with setae normal and unmodified; tarsal claw not fully pectinate, gap between apical tarsal tooth and claw greater than apical tooth length; 6–7 teeth in basal pectin; apical tarsal tooth with a small seta-like tip. **Wings**: forewing with second submarginal cell irregular in shape, vein 2RS not parallel with r-m; forewing width/length at widest point greater than .29, less than .35; length ratio of veins 3RSa/r about 1.43, vein 1cu-a positioned ⅓ distance between veins 1M and m-cu (closer to 1M); hindwing marginal cell narrowest at base, RS gradually curved to wing margin; vein r-m length 0.6 times 1M. **Metasoma**: tergum I elongate, apical width/tergum length ratio less than 0.87; tergum I sculpturing faintly rugulocostate; median carina pronounced; median carina of tergum II pronounced; median triangle at base of tergum II large and associated with anterior carinae which run laterally to margins of tergum; tergum III sculpturing shallowly rugulose or rugulocostate anteriad, finely punctate posteriad; medial pits on terga 4–7 of males absent; ovipositor short, less than ½ length of metafemur.

Type material examined.—Holotype male, pinned, 4 labels (excluding ANSP tag), Cuba, Prof. Poey, type #1663.1 (Philadelphia). Condition of holotype fair; distal ends of both antennae lost, left antenna 25% shorter than right; left middle leg lost; tarsi of right middle leg and both hind legs lost. One male paratype, Cuba, type #1663.2 (Philadelphia).

Other Specimens Examined.—Only two non-type specimens were seen (females from the USNM collection).

Distribution.—Cuba.

Comments.—*Aleiodes flavidus* is a distinctive species that can be recognized by its exceptionally large body size, enormous eyes and ocelli (Fig. 1), deeply yellow-colored and black-tipped wings (Fig. 36), and extensive granulate sculpture. It is, however, rare in North American collections (we have only seen the holotype, paratype, and two other specimens). Its nearest relative is *pedalis*, which differs by having the head and apical ½ (or more) of the middle tibia black in females (see Figs. 26, 28), and sometimes by having a black median wing band or cloud.

Aleiodes geometrae (Ashmead), new combination
(Figs. 6, 17, 19, 25, 30, 35, 42)

Rhogas geometrae Ashmead, 1889 (1888), Proc. U.S. Nat. Mus. 11: 633.

Diagnosis.—Body unicolored honey-yellow to orange, antenna black, wings hyaline, veins light brown, tegula yellow; body length, 5.0–6.0 mm; 43–56 antennomeres; malar space short, equal to or less than basal width of mandible; oral opening small, circular; occipital carina weak or absent on vertex (Figs. 6, 35); ocelli large, lateral ocellus 1.5 times wider than ocell-ocular distance (Figs. 6, 42); face weakly costate, frons, vertex and temple granulate; mesonotum and scutellum granulate; mesopleuron smooth, subalar sulcus weakly rugose, sternaulus absent; propodeum rugose-granulate, median carina complete; forewing (Fig. 42) with vein 1cu-a beyond 1M by distance greater than length of 1cu-a; hind wing with marginal cell gradually widening apically, vein RS straight, vein 1r-m nearly as long as 1M; tarsal claws with a wide gap between the apical claw and basal pectination (Fig. 19); first and second metasomal terga costate, median carina complete, third tergum cos-

tate on basal ½, median carina absent, metasomal terga 4–6 in male with small pits medially (Fig. 17).

Type material examined.—*Rhogas geometrae* Ashmead, lectotype male (here designated), USA, Missouri, reared from an unknown geometrid larva, May 5, 1877, C.V. Riley [USNM]; 2 paralectotype males, same data, [USNM].

Distribution.—Ontario south to Florida, west to North Dakota, Colorado, and Texas. The period of flight activity for adults ranges from mid-March to mid-August.

Biology.—Reared from the geometrids *Paleacrita vernata* (Peck) and *Semiothisa ocellinata* (Gn.). One specimen from Texas was reared from an unidentified host on honey locust.

Comments.—This species is not very common in collections, considering the usual abundance of the hosts. Collecting efforts should focus on trying to rear it from host larvae. It can be recognized most easily by its broadly effaced occipital carina, tarsal claws with a wide gap between the apical claw and basal pectination, and median pits on the male metasomal terga 4–6. We have seen one unusual male specimen from Rio Grande Valley State Park, Hidalgo County, Texas [TAMU] that has some dark markings on the metasoma, a white annulus on the flagellum, and the first metasomal segment longer than wide. This may represent an additional new species near *geometrae*, but we hesitate to describe it until more material is available.

Aleiodes insignipes (Brues), new combination

Rhogas insignipes Brues, 1912, Ann. Ent. Soc. Amer. 5: 221.

Diagnosis.—Body uniformly pale yellow, except head, antenna, pterostigma, last segment of fore tarsus, middle leg beyond basal ⅓ of tibia, and hind leg beyond extreme base of tibia black; wings hyaline to pale yellow-fuscous, veins light brown; body length, 8.0 mm; 65 antennomeres; malar space extremely short, ½ as wide as basal width of mandible; oral opening small, circular; occipital carina weak or absent on vertex; ocelli extremely large, lateral ocellus 15 times wider than ocell-ocular distance, nearly touching compound eye; face weakly transversely rugose aciculate; frons, vertex and temple granulate; mesonotum and scutellum granulate; mesopleuron smooth, subalar sulcus weakly rugulose, sternaulus absent; propodeum granulate, median carina complete; forewing with vein 1cu-a beyond 1M by distance greater than length of 1cu-a; hind wing with marginal cell strongly widening apically, vein RS slightly curved medially, vein 1r-m about ⅔ as long as 1M; tarsal claws with a wide gap between the apical claw and basal pectination, pectination reduced to 4–5 setalike spines; first metasomal tergum long and narrow, 1.3 times longer than wide; first and second metasomal terga weakly costate to granulate, median carina complete, third tergum weakly granulate, median carina absent, metasomal terga 4–6 in male without small pits medially.

Type material examined.—*Rhogas insignipes* Brues, holotype male, BRAZIL, "Parahyba" [Paraiba], Independencia, Stanford University Expedition, 1911, Mann and Heath, type #29922 [MCZ].

Distribution.—Known only from the type-locality in north-east Brazil.

Biology.—Unknown.

Comments.—This species is quite similar to *vaughani*, with respect to most aspects of body form and color. However, *insignipes* has much larger eyes and ocelli, smaller malar space, darker middle tibia, reduced tarsal claw pectination, and longer first metasomal tergum. The female of *insignipes* is unknown. Brues (1912) noted that this species has "about 65" antennomeres. The apices of the antennae are now missing from the holotype, so we were unable to check this observation. If

correct, this is substantially more than the usual number (43–56) in *vaughani*.

Aleiodes notozophus Marsh and Shaw, new species
(Figs. 3, 9, 29, 34, 38, 43)

Female.—**Body color**: head including antennae dark brown to black; apical palpomeres varying from light brown to nearly white; mesosoma except propodeum brown to dark brown, propodeum always light brown; metasoma light brown; legs light brown, occasionally fore leg and hind tibia darker; wings hyaline, veins brown, tegula brown. **Body length**, 6.5–7.0 mm; fore wing length, 7.0–7.5 mm. **Head** (Figs. 3, 34): 51–54 antennomeres, basal flagellomeres about as wide as long; malar space very short, ⅛—⅛ eye height and ⅔ basal width of mandible; temple very narrow, at its narrowest ⅓ eye width; occipital carina meeting hypostomal carina; oral opening small, circular, width equal to basal width of mandible and about ⅔ face height; clypeus swollen, striate; ocelli large, ocellocular distance at most ¼ diameter of lateral ocellus, often lateral ocellus nearly touching eye; face costate, frons smooth, vertex and temple granulate, malar space sometimes weakly costate; maxillary palpus not swollen. **Mesosoma**: propleuron weakly costate, porcate medially; mesonotum and scutellum granulate, notauli weakly scrobiculate, meeting before scutellum in shallow costate area; mesopleuron smooth, subalar area weakly costate, sternaulus absent; propodeum granulate to granulate dorsally, smooth laterally, median carina complete. **Legs**: tarsal claws strongly pectinate with 7–8 large spines on inner edge; hind coxa weakly granulate dorsally; inner spur of hind tibia equal to ½ length of basitarsus. **Wings** (Figs. 38, 43): fore wing with vein r nearly ½ length of 3RSa and about ¾ length of m-cu, vein 1cu-a beyond 1M by distance slightly greater than length of 1cu-a, vein 1CUa about ⅓ length of 1CUb; hind wing with vein RS straight, marginal cell gradually widening to wing apex, veins M+CU and 1M about equal in length, vein 1r-m ⅗ length of 1M, vein m-cu absent. **Metasoma**: first tergum strigate, length longer than apical width, median carina complete; second tergum strigate, median carina complete; third tergum weakly strigate at base, remainder smooth, median carina absent; remainder of terga smooth; ovipositor short, about ¼ length of hind basitarsus.

Male.—Similar to female; fore legs light brown to yellow; median pits present on metasomal terga 4–7.

Holotype.—Female: CALIFORNIA, Tin Mine Canyon, Riverside County, December 14, 1963, ex. oak gall, M. E. Irwin collector. Deposited in USNM.

Paratypes.—COSTA RICA: 2 females, Guanacaste Prov., Derrumbe, Est. Cacao, lado oeste del V. Cacao, III curso Parataxon., May 1992, L-N 323700, 376700, INBio barcodes CR1000–423504 and CR1000–423594. UNITED STATES: ARIZONA: 1 female, Ramsey Canyon 6000′, 15 mi. S. Sierra Vista, Huachuca Mts., October 23, 1967, Sternitzky; 1 female, Parker Creek, Sierra Ancha, May 2, 1947, H. and M. Townes. CALIFORNIA: 5 females, Santa Margarita, 20 mi. ESE, 2200′, October 9, 1966, D. F. Hardwick; 1 male, Cypress Ridge, Marin Co., May 7, 1922, E. C. van Dyke collector; 1 male, Calaveras Co., 4.8 km S. West Point, July 26, 1980, Stanley C. Williams; 1 male, Mill Valley, Marin Co., March 16, 1959, H. B. Leech collector; 1 female, Meadow Vista, Placer Co., October 19, 1972, T. A. Sears; 1 female, S. D. Co., Potrero, April 8, 1974, H. and M. Townes; 1 male, Lake Wohlford, April 20, 1974, H. and M. Townes; 1 female, same data except April 24; 1 female, same data except April 27; 2 females, same data except April 30. FLORIDA: 1 male, Putnam Co., 2 mi. NW Orange Springs, May 22, 1975, D. Bowman, blacklight trap. Paratypes deposited in USNM, CNC, RMSEL, CAS, UCD, AEI, INBio, FSCA.

Distribution.—Known only from Flori-

da, the southwestern U.S., and Costa Rica, suggesting that *notozophus* may occur in the gulf states, Mexico, and other parts of Central America as well. Possibly occurring in Brazil (see comments below).

Biology.—Unknown. The holotype is labeled as having emerged from an oak gall, but this seems unlikely. Possibly a mummified host caterpillar was confused with a gall or a parasitized caterpillar sought shelter in the gall. It is attracted to lights.

Comments.—This species is similar in habitus to *arizonensis,* including the males with the medial pits on metasomal terga 4–7, but is distinguished by the darker colored head, mesosoma, and legs (Fig. 29). It is also similar to *vaughani* from Central America but is distinguished by the maxillary palpi being slender (not swollen), and by the longer first metasomal tergum. One male specimen from Paranã, Brazil [CNC] fits this description but has lighter colored orbits around the eyes, light medial bands on the antennae, and reduced pectination on the tarsal claws. Based on this specimen alone, we are not able to judge if this is normal variation at the southern part of the range of this species, or whether this lone male represents another species near *notozophus.*

Etymology.—The specific name is from the Greek *noto* meaning "south" and *zophos* meaning "western" in reference to the more frequent occurrence of this species in the southwestern U.S.

Aleiodes pedalis Cresson
(Figs. 28, 37, 45)

Aleiodes pedalis Cresson, 1869, Trans. Am. Ent. Soc. 2:379–380.

Re-description of holotype female.—**Body color**: yellowish orange, except head, antenna, fore basitarsus, apical ½ middle and hind tibiae and tarsi, stigma medially, and ovipositor sheath black; palpi and basal ½ middle and hind tibiae pale yellowish white; wings hyaline except faint infumation medially on forewing, darker infumation apically. **Body length**, 8.3 mm; forewing length 9.0 mm. **Head**: ocelli enormous, lateral ocellus 8 times wider than ocell-ocular distance; 66 antennomeres, basal flagellomeres shorter than wide, 15th flagellomere width/length ratio less than 0.84, apical flagellomere terminating in a sharp point; malar space very short, shorter than basal width of mandible; malar space/eye height ratio 0.06; temple/eye width ratio 0.10; occipital carina meeting hypostomal carina ventrally, absent at vertex; oral space/malar space ratio 3.0, oral space small, circular, and polished, oral opening width shorter than clypeo-antennal distance; clypeal height/width ratio 0.67; clypeal sculpturing finely rugulose; medial ridge extending down frons less than 0.55 distance from scape to clypeus; face granulate medially, striate laterally (Fig. 45); frons smooth; vertex striate; temple granulate; maxillary palpus not swollen. **Mesosoma**: pronotum granulate medio-anteriad, rugose laterally, declining at angle of greater than 45° from mesonotum, medial pronotal length short, about equal to length between occipital carina and lateral ocellus; mesonotum granulate, postero-dorsally with one smooth carina (otherwise mesonotum damaged by pinning); notauli smooth, not coarsely foveate; scutellum granulate, without pronounced setal pits; mesopleuron smooth, sternaulus absent; mesopleural pit posteriad to central disk absent; propodeum granulate, antero-laterally with faint rugation; propodeal median carina present, complete to apex. **Legs**: inner apex of hind tibia with setae normal and unmodified; tarsal claw with basal lobe strongly pectinate, gap between apical pectin tooth and claw greater than apical tooth length, 7–8 teeth in pectin; hind tibial spur/hind basitarsus length ratio 0.30; hind coxa dorsally granulate. **Wings**: yellowish hyaline, except apex and median band infumate; forewing width/length at widest point 0.29–0.35, forewing with vein 2RS not parallel with r-m;

3RSa/r ratio 2.0; 1cu-a beyond basal vein by 3 times 1cu-a length; vein 1cu-a about ⅓ of way between veins 1M and m-cu (closer to 1M); hind wing with marginal cell gradually widening, RS gradually curved to wing margin; M+CU/1M ratio 0.53; vein r-m 0.6 times length of 1M; m-cu absent. **Metasoma**: carapace absent, terga 1–8 visible; first and second terga with distinct median carina; first tergum elongate, faintly rugulose to granulate, length/width ratio 1.13; second tergum rugulose to granulate, length/width ratio 0.71, median triangle of second tergum large, with anterior carinae running laterally to margins; third tergum length/width ratio 0.44; third and forth terga granulate; ovipositor length/hind basitarsus length ratio 0.60.

Type material examined.—Holotype female, minuten-mounted into cork, 3 labels (excluding ANSP tag), Mexico, Prof. Sumichrast, (Philadelphia). Condition fair; left flagellum broken near middle, about ½ as long as right flagellum.

Distribution.—Mexico, Costa Rica, Panama, Venezuela, and Bolivia.

Biology.—Unknown.

Comments.—A very distinctive species that can easily be recognized by its exceptionally large body size, very large eyes and ocelli, black head, extensive granulate sculpture, and face laterally with well-developed parallel striations (Fig. 45). It is, however, quite rare in North American collections (we have only seen the holotype, three specimens from Costa Rica, and single specimens from Panama, Venezuela, and Bolivia). The female from Costa Rica is somewhat larger than the holotype from Mexico, and differs by having darker black wing bands, and the hind femur mostly black. Two males from Costa Rica, and one from Panama, lack the medial wing band, have the hind femur orange, and do not have setose pits on the apical terga. The specimens from Venezuela and Bolivia are unusual in lacking dark wing patches, but otherwise are within the observed range of variation for Central American specimens. Its nearest relative is *flavidus* (Cresson) from Cuba, which differs by having a yellowish orange head and middle tibia The face is faintly striate in *flavidus*, but not so strongly as in *pedalis*. Although originally described as an *Aleiodes* species, *pedalis* has been classified as *Rogas* by recent authors (e.g. Shenefelt, 1975), and it is here reassigned to its original generic combination.

Aleiodes quebecensis (Provancher), new combination
(Figs. 5, 8, 14, 23–24, 32)

Rogas quebecensis Provancher, 1880, Nat. Can. 12:145.

Diagnosis.—Body unicolored honey yellow or light brown, antenna usually black on basal ½, yellowish-white to orange on apical ½, occasionally entirely black, or with apical 10–18 flagellomeres black, fore leg yellow, apical tarsomere brown, middle leg with coxa brown, trochanters and basal ¼ of femur yellow, apical ¾ of femur brown, basal ½ of tibia yellow, apical ½ brown, tarsomeres 1–4 yellowish white or white, apical tarsomere brown, hind leg with coxa brown, trochanters yellow, femur brown, basal ⅓ of tibia yellow or white, apical ⅔ brown, tarsomeres 1–4 white or light yellow, apical tarsomere brown, wings hyaline, veins including stigma brown, tegula yellow; body length, 6.0–8.0 mm; 45–55 antennomeres; malar space short, less than basal width of mandible and about ⅙ eye height; face rugulose, frons smooth, vertex and temple granulate; oral opening small and circular, diameter greater than malar space; ocelli large, lateral ocellus 3 times wider than ocell-ocular distance (Fig. 5); pronotum rugose; mesonotum and scutellum granulate; mesopleuron smooth or weakly granulate, subalar sulcus rugose, sternaulus absent; propodeum rugose granulate, median carina complete; first and second metasomal terga rugulose to granulate,

median carinae complete, third tergum smooth or weakly granulate, median carina absent, terga 4–6 of males with dense patches of long hair on each side of mid line; tarsal claws strongly pectinate (Fig. 14); fore wing with vein 1cu-a beyond 1M by distance greater than length of 1cu-a; hind wing with vein RS slightly arched at apical ⅔, marginal cell narrowest at apical ⅔ and suddenly widened to apex, vein m-cu very short and indistinct.

Type material examined.—*Rogas quebecensis* Provancher, holotype female, Quebec [ULQ].

Distribution.—Quebec south to Florida, west to Wisconsin, South Dakota, British Columbia, and Oregon. The period of flight activity for adults ranges from early June through mid-August.

Biology.—Reared from *Acronicta furcifera* Guen. and *Acronicta grisea* Wlk. One reared specimen from Indiana has been associated with *Prunus sordinia* and another from New Brunswick has been associated with choke cherry, indicating the possibility that several other *Acronicta* are potential hosts. Another from Wisconsin has been associated with *Tilia americana*. It has been collected at blacklights.

Comments.—This species is very distinctive and can be distinguished from all other members of the *pulchripes* group by the arched vein RS in the hind wing, and the hind legs with their pale white or yellowish tarsomeres (Fig. 24). A single specimen examined from Oregon is much darker than eastern specimens in the color of the head, mesosoma, and apical ½ of the hind tibia.

Aleiodes rossi Marsh and Shaw, new species
(Figs. 15, 20)

Female.—**Body color**: entire body light yellow, antennal flagellum brown, scape and pedicel honey yellow, ocellar triangle black, all apical tarsal segments brown, apex of hind tibia black, wing veins yellow except costa, stigma and metacarpus which are brown. **Body length**, 6.5 mm; fore wing length, 5.5 mm. **Head**: 44 antennomeres, first flagellomere longer than second, remainder as wide as long; malar space short, slightly less than basal width of mandible and about ¼ eye height; occipital carina not reaching hypostomal carina; oral space small and circular, width equal to basal width of mandible and ½ length of face; clypeus not swollen; ocelli large, ocellocular distance less the ½ diameter of lateral ocellus; face granulate, costulate below antennae; frons, temples and vertex granulate; maxillary palpus not swollen; mandibles small, tips not crossing when closed. **Mesosoma**: propleuron porcate; mesonotum and scutellum granulate, notauli weakly scrobiculate, meeting in rugose triangular area before scutellum; mesopleuron smooth, subalar sulcus rugose, sternaulus absent; propodeum granulate laterally, rugose granulate dorsally, median carina complete. **Legs**: tarsal claws pectinate but with only 8–9 stout spines, with the basal 5 being much larger than the rest (Fig. 20); inner spur of hind tibia less than ½ length of hind basitarsus; hind coxa granulate dorsally. **Wings**: fore wing with vein r ½ length of 3RSa and ⅔ length of m-cu, vein 1cu-a beyond 1M by distance greater than length of 1cu-a, vein 1CUa ⅔ length of 1CUb; hind wing with vein RS nearly parallel for short distance at base and then widening to apex, marginal cell wide at apex, vein 1r-m slightly longer than 1M, vein M+CU longer than 1M, vein m-cu absent. **Metasoma**: first tergum costate, apical width longer than length, median carina complete; second tergum costate, median carina complete; third tergum costate on basal ½, granulate on apical ½, median carina distinct on basal ½; remainder of terga smooth; ovipositor short, less than ½ length of hind basitarsus.

Male.—As in female; metasomal terga 4–7 with dorsal median pits (Fig. 15).

Holotype.—Female: TEXAS, Brownsville,

October, 1942, E. S. Ross, at light. Deposited in CAS.

Paratypes.—MEXICO: 2 males, San Luiz, Potosi, El Salto, 1800′, June 8, 1961, U. Kans. Mex. Exped. UNITED STATES: TEXAS: 1 male, Brownsville, September 16, 1942, T. M. Burns collector; 1 male, Brownsville, June 29, 1938, L. W. Hepner; 1 female, S. Patricio Co., Welder Wildlife Ref., 8 mi. NE Sinton, May 13–15, 1985, R. Brown, black light trap, William H. Cross Expedition. Paratypes deposited in USNM, MSSU, UKL.

Distribution.—Known only from southern Texas and Mexico.

Biology.—Hosts unknown. Adults are attracted to lights.

Comments.—This species belongs to the group in which the males have the medial pits on the apical metasomal terga; it can be distinguished from *cameronii* by the position of vein 1cu-a in the fore wing and from *cazieri* by its brown antenna and stigma. It can be distinguished from *geometrae* by the presence of dark black markings on the apices of the tibiae, especially the hind tibia.

Etymology.—This species is named for the collector of the holotype, E. S. Ross.

Aleiodes vaughani (Muesebeck), new combination (Figs. 4, 7, 22, 31)

Rhogas nigriceps Enderlein, (1918) 1920, Arch. Naturgesch. 84A(11):155. New junior homonym, preoccupied by *nigriceps* Wesmael 1838 and *nigriceps* Brethes 1909. All three nominal taxa are different species.

Rogas vaughani Muesebeck, 1960, Ent. News 71: 257.

Rogas enderleini Shenefelt, 1975, Hym. Cat. 12(8):1227–1228. New synonymy. Unnecessary replacement name for *nigriceps* Enderlein.

Description of female.—**Body color**: reddish yellow to yellow; head and antennae black; palpi piceous; wings hyaline, the stigma and veins very dark; middle tarsus dusky; apex of hind tibia and the hind tarsus blackish; ovipositor sheath black. **Body length** about 6 mm. **Head**: ocelli large, lateral ocellus 3 times wider than ocell-ocular distance; 43–48 antennomeres, basal flagellomeres longer than wide, 15th flagellomere from base width/length less than .84; malar space slightly shorter than basal width of mandible; oral opening circular, width shorter than the clypeo-antennal distance; clypeus without a carina, clypeal height/width between .65 and .42, clypeal sculpturing finely rugulose, clypeal shape rounded, not abruptly edged, not flat ventrad; vertex granulate; occipital carina strong and complete medially, but effaced well before juncture with hypostomal carina; medial ridge extending down frons less than .55 of distance from line between bases of scapes to clypeus. **Mesosoma**: pronotum granulate medio-anteriad, laterally costate, pronotum declining at an angle of greater than 45 degrees from mesonotum, pronotal anterior flange less than .28 of pronotal length, pronotal medial length longer than length between occipital carina and lateral ocellus; mesopleuron sculpturing on and posteriad to central disk smooth, punctate; sternaulus smooth, sometimes slightly indented; mesopleural pit posteriad to central disk absent; posterio-dorsal surface of mesonotum with some strong, smooth carinae; notauli at mid-dorsal surface of mesonotum not coarsely foveate, but with a long longitudinal carina; mesonotal sculpturing excluding postero-dorsal surface granulate; scutellum granulate, without pronounced hair pits; median carina of propodeum frequently interrupted before reaching propodeal apex; sculpturing of propodeum antero-laterally finely rugulose. **Legs**: inner apex of hind tibia with setae normal and unmodified; metatarsal segment IV length less than 1.5 times width; tarsal claw strongly pectinate with 10–12 tarsal teeth in pectin; gap between apical and subapical tarsal teeth; apical tarsal tooth with a small seta-like tip. **Wings**: forewing with second submargin-

al cell irregular in shape, 2RS not parallel with r-m; forewing width/length greater than or equal to .35; length ratio of vein 3-RS/r about 2.5; vein 1cu-a about halfway between veins 1M and m-cu; hindwing marginal cell narrowest at base, RS straight; veins M+CU and 1M about equal in length; vein 1r-m about ⅓ length of 1M. **Metasoma**: first tergum not elongate, sculpturing weakly rugulose to faintly rugulocostate, median carina pronounced; median carina of second tergum pronounced, basal median triangle large and associated with carinae which run laterally to margins of tergum; third metasomal tergum sculpturing shallowly rugulose or rugulocostate anteriad, finely punctate posteriad, or completely finely punctate; medial pits on terga 4–7 of males absent; ovipositor short, less than ½ length of metafemur.

Males.—Essentially as in female; greater tendency in males for third metasomal tergum to have more rugation and to be less nitid.

Type material examined.—Rogas vaughani Muesebeck, holotype female, type #65047, Managua, Nicaragua, ex. *Laphygma* (=*Spodoptera*) *frugiperda*, deposited in USNM. The holotype female of *Rhogas nigriceps* Enderlein was also examined.

Distribution.—Found in the Neotropical region from Mexico southwards to Honduras, Nicaragua, Costa Rica, and Ecuador. A series of specimens from Costa Rica (INBio) indicates that *vaughani* occurs from sea level to 1050m elevation, but seems to be most common at lower elevations (0–200m).

Biology.—The type-series from Nicaragua was associated with host material identified as *Laphygma* (=*Spodoptera*) *frugiperda* (Noctuidae). One specimen of *vaughani* from Honduras was associated with host material identified as *Spodoptera sunia* (Noctuidae). Several specimens from Ecuador were reared from *Spodoptera latifascia*. This species is attracted to lights.

Comments.—*Aleiodes vaughani* is one of only four species in the group that have a dark-colored head (the other three being *pedalis*, *insignipes* and *notozophus*). It differs from *pedalis* in that the wings are not banded; it differs from *notozophus* by having the maxillary palpus somewhat swollen and by having a gap between the apical tarsal claw and its basal pectination; it differs from *insignipes* by having smaller ocelli, larger malar space and more distinct tarsal claw pectination. Of the four species, *vaughani* is by far the most common and appears to readily attack several species of noctuids that infest agroecosystems. We have also examined a dark-colored form from Ecuador which has the anterior half of the mesosoma black in addition to the head. However, these do not differ morphologically from typical *vaughani*.

ACKNOWLEDGMENTS

This research was supported, in part, by grant DEB-930-6314 from the National Science Foundation. Additional support was provided by supplemental REU grants in 1994, 1995, and 1996 (Research Experience for Undergraduates). Support was also provided by a Faculty Grant-in-Aid from the University of Wyoming Research Office, and U.W. Experiment Station Project WYO-256-90. We note with appreciation that the host associations for *Aleiodes cameronii* were discovered and verified by Alex Segarra and Pedro Barbosa (University of Maryland) as part of their ongoing study of parasitoid host ranges. Additional thanks are due to Ms. Isobel Nichols for preparation of ink illustrations, and also to Ms. Teresa Williams, of the Western Research Institute, for assistance with the Environmental Scanning Electron Microscope and photography. We also thank the curators of the museums mentioned in the Methods section for the loan of specimens used in this study.

LITERATURE CITED

Achterberg, C. van. 1982. Notes on some type-species described by Fabricius of the subfamilies Braconidae, Rogadinae, Microgastrinae and Agathidinae (Hymenoptera, Braconidae). *Entomologische Berichten Amsterdam* 42: 133–139.

Achterberg, C. van. 1985. IV. The *Aleiodes dispar*-group of the Palaearctic region (Hymenoptera: Braconidae: Rogadinae). *Zoologische Mededelingen Leiden* 59: 178–187.

Achterberg, C. van. 1991. Revision of the genera of

the Afrotropical and W. Palaearctic Rogadinae Foerster (Hymenoptera: Braconidae). *Zoologische Verhandelingen* 273: 1–102.

Achterberg, C. van. 1995. Six new species of the *Aleiodes dispar* group (Hymenoptera: Braconidae: Rogadinae). *Zoologische Mededelingen Leiden* 69: 1–18.

Ashmead, W. H. 1889 (1888). Descriptions of new Braconidae in the collections of the U. S. National Museum. *Proceedings of the U. S. National Museum* 11: 611–671.

Brues, C. T. 1912. Brazilian Ichneumonidae and Braconidae obtained by the Stanford Expedition. *Annals of the Entomological Society of America* 5: 193–229.

Cameron, P. 1887. Family Braconidae. In, *Biologia Centrali-Americana. Insecta.* 1: 312–419.

Cresson, E. T. 1865. On the Hymenoptera of Cuba. *Proceedings of the Entomological Society of Philadelphia* 4: 1–200.

Cresson, E. T. 1869. List of the North American species of the genus *Aleiodes* Wesmael. *Transactions of the American Entomological Society* 2: 377–382.

Dalla Torre, C. G. 1898. *Catalogus Hymenopterorum. 4. Braconidae.* G. Engelmann, Leipzig. 323 pp.

Goulet, H. and J. T. Huber. 1993. *Hymenoptera of the World: An identification guide to families.* Agriculture Canada Publication 1894/E, Ottawa.

Harris, R. A. 1979. A glossary of surface sculpturing. *Occasional Papers in Entomology* 28: 1–31.

Marsh, P. M. 1979. Family Braconidae. Pp. 144–313, In: Krombein, K.V., P. D. Hurd Jr., D. R. Smith, and B. D. Burks [eds.], *Catalog of Hymenoptera in America North of Mexico,* Smithsonian Institution Press, Washington, D.C.

Marsh, P. M. 1989. Notes on Braconidae (Hymenoptera) associated with jojoba (*Simmondsia chinensis*) and descriptions of new species. *Pan-Pacific Entomologist* 65: 58–67.

Marsh, P. M., S. R. Shaw and R. A. Wharton. 1987. An identification manual for the North American genera of the Family Braconidae (Hymenoptera). *Memoirs of the Entomological Society of Washington* 13: 1–98.

Muesebeck, C. F. W. 1960. New reared Neotropical species of *Rogas* Nees (Hymenoptera: Braconidae). *Entomological News* 71: 257–261.

Provancher, L. 1880. Faune Canadienne. *Le Naturaliste Canadien* 12: 130–147.

Shaw, M. R. 1983. On[e] evolution of endoparasitism: the biology of some genera of Rogadinae (Braconidae). *Contributions of the American Entomological Institute* 20: 307–328.

Shaw, M. R. 1994. Chapter 7, Parasitoid host ranges. Pp. 112–144, In: Hawkins, B. A. and W. Sheehan [eds.], *Parasitoid Community Ecology,* Oxford University Press, Oxford.

Shaw, M. R. and T. Huddleston. 1991. Classification and biology of braconid wasps. *Handbooks for the Identification of British Insects* 7: 1–126.

Shaw, S. R. 1993. Systematic status of *Eucystomastax* Brues and characterization of the Neotropical species. *Journal of Hymenoptera Research* 2: 1–11.

Shaw, S. R. 1995. Chapter 12.2, Braconidae. Pp. 431–463, In: Hanson, P. E. and I. D. Gauld [eds.], *The Hymenoptera of Costa Rica,* Oxford University Press, Oxford.

Shenefelt, R. D. 1975. Braconidae 8: Exothecinae, Rogadinae. Pp. 1115–1262, In: van der Vecht, J and R. D. Shenefelt [eds.], *Hymenopterorum Catalogus* (new edition), W. Junk B.V., The Hague.